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ABSTRACT

The purpose of this study was to determine if fine motor performance differences existed between high and low social status males and females. Sixty fourth, fifth, and sixth graders were studied. Both the high and low social status groups had equal numbers of males and females, and each group had the same number of fourth, fifth, and sixth graders. Each student was administered four tests that measured psychomotor skills. It was concluded that the motor performance differences help support the contention that high social status groups may be superior to low social status groups on selected motor performance tasks. (Author/CJ)

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Fine Motor Performance Differences
Between High and Low Social Status Children

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ABSTRACT

The purpose of this study was to determine if fine motor performance differences existed between high and low social status males and females. The Hollingshead Two-Factor Index of Social Position was used to create the high and low social status groups based on the parent's education and occupation. Five social status categories were created with the top two categories representing the high group and the last two categories representing the low group. Three hundred fourth, fifth and sixth grade children were surveyed to determine their social status and 60 of these children were selected for the study. The high social status group (N=29) and the low social status group (N=31) each contained approximately equal numbers of males and females, as well as approximately equal numbers of fourth, fifth, and sixth graders. Each subject was administered the following tests designed to measure some aspect of fine motor performance: (1) the Pursuit Rotor Task, (2) the Arm Tapping Speed Test, (3) the Purdue Hand Precision Test, and (4) the Minnesota Manual Dexterity Test. A 2 x 2 x 3 repeated measures ANCOVA design was used to determine the effects of social status, grade level, and gender. Age was used as a covariate in the design. Social status differences in favor of the high group in each case were found for the Pursuit Rotor Task and the Tapping Speed Test. A Social Status X Grade Level interaction was observed for the Purdue Hand Precision Test - On Count and the Pursuit Rotor Task. A Social Status X Gender interaction was noted for the Purdue Hand Precision Test - Stylus Count and a grade level difference was established using the Purdue Hand Precision Test - On Time. Since gross motor performance differences have been reported between high and low social status groups in favor of the high groups in another similar study, it was concluded that these fine motor performance differences help support the contention that high social status groups may be superior to low social status groups on selected motor performance tasks.

Fine Motor Performance Differences
Between High and Low Social Status Children

Introduction

Interest in this study came about as a result of a previous study conducted by Edwards (1976), in which he investigated the relationship between intellectual and motor performance in pre-adolescent children using "culturally loaded and free" instruments. Findings of the study included a positive significant relationship between motor and intellectual performance in high and low social status groups, significant intellectual performance differences between high and low social status groups, and significant motor performance differences between high and low social status groups. A finding not hypothesized was that selected gross motor coordination variables could be used to discriminate between high and low social status groups.

Research into the area of gross motor performance of children and its relationship to other variables has generally indicated a significant difference favoring males when sexes are compared (Keogh, 1965; Milne, Seefeldt & Reuschlein, 1976; Phillips, 1955), a significant difference on the variable, age, as would be expected (Ammons, Alprin & Ammons, 1955; Anshel, 1979), and contradictory findings when

comparing gross motor performance and intelligence (Kirkendall & Ismail, 1970; Singer, 1963; Bauer, 1961). It does appear, however, that motor coordination items, especially of upper and lower limbs, along with a few athletic performance items like the standing broad jump and shuttle run, have been shown to be most important when investigating the relationship between the physical and intellectual domains of development (Ismail & Cowell, 1971; Ismail & Kirkendall, 1970; Edwards, 1976).

When investigating the literature available on fine motor performance of children and its relationship to age and intelligence, two of the variables mentioned in the preceding paragraph, differences are noted. Ammons and others (1955) tested performance of children in grades one, three, six, and nine on the pursuit rotor task and found that boys and girls performed similarly, but that performance increased significantly with age. Anshel (1979), while looking at the type of feedback on motor performance and locus of control of fifth and eighth graders, also found that age was highly significant, but that the sex variable showed no significance. It could well be that fine motor tests, such as the pursuit rotor task, are not 'culturally loaded' tests as are many motor performance tests such as throwing, striking, and jumping tests, where males have a cultural and physical advantage over females.

Social status as it relates to other variables has been a very popular research target in the past thirty years,

being compared to almost every variable conceivable. Some of the more generalized conclusions of this research are that mental ability differences (Ellwood, 1974; Harris, 1976; Jensen, 1974), achievement differences (Fruitt, 1979; McGill, 1978; Touliatos, 1978), and motor performance differences (Edwards, 1976; Williams, 1972; Kirkendall & Ismail; 1970) do exist between high and low social status children. The studies in motor performance and social status have shown contrary results, however, due to the definition and evaluative tools used to test motor performance. Generally speaking, when gross motor items such as speed, strength, agility, endurance, and flexibility are used, the results indicate lower social status children achieving significantly higher scores on some variables, and higher social status children achieving significantly higher scores on others. When testing fitness measures, Ponthierx (1965) found lower socioeconomic females to be faster, better coordinated, and possessing more endurance than upper status children, while lower status males were also faster and better coordinated than upper status children.

Through several studies (Ismail & Lowell, 1971; Kirkendall & Ismail, 1970; Ismail & Kirkendall, 1970) involving factor analysis techniques, Ismail, and others were able to determine that gross motor coordination items, especially of upper and lower limbs, were most important in discriminating between physical and intellectual domains of

of development. Edwards (1976), applying discriminate function analysis techniques to data collected on children of high and low social status, was able to determine that selected gross motor coordination items could be used to discriminate between high and low social status groups. As a result of Edwards study, this study was undertaken for the purpose of determining whether selected fine motor performance variables could better discriminate between high and low social status children than gross motor performance variables. Sub problems of the study were to investigate differences in grade level, sex, and age on fine motor performance.

Method

Subjects

Approximately three hundred fourth, fifth, and sixth grade students from a small community school north of Salt Lake City were used as a potential pool of subjects. A survey was sent home with these subjects to determine their social status and to obtain informed consent of their parents. The Hollingshead Two-Factor Index of Social Position ($\text{Index} = \text{Occupation} \times 7 + \text{Education} \times 4$) was used to create the high and low social status groups based upon the parent's education and occupation. Five social status categories were created with the top two categories representing the high group and the last two categories representing the low group. The sixty subjects selected were grouped according to the criteria of gender, social status and grade level:

High Social Status

Fourth Grade Females N = 3
 Fourth Grade Males N = 5
 Fifth Grade Females N = 5
 Fifth Grade Males N = 7
 Sixth Grade Females N = 5
 Sixth Grade Males N = 4

Total -29

Males N = 31

Females N = 29

Low Social Status

Fourth Grade Females N = 5
 Fourth Grade Males N = 7
 Fifth Grade Females N = 5
 Fifth Grade Males N = 5
 Sixth Grade Females N = 6
 Sixth Grade Males N = 3

Total -31

Fourth Grade N = 20

Fifth Grade N = 22

Sixth Grade N = 18

Instrumentation

Aspects of fine motor performance were assessed by administering the following tests: (1) the Pursuit Rotor Task, (2) the Arm Tapping Speed Test, (3) the Purdue Hand Precision Test - On Count, and (4) the Minnesota Manual Dexterity Test. The subject was given eight fifteen second trials on the first three tests, and two timed trials on the Minnesota Manual Dexterity Test. The variables measured were the number of correct hits on the Tapping Tests; the time on target on the Pursuit Rotor Task; the number of correct hits, the number of attempts, and the stylus time on target on the Purdue Hand Precision Test; and the total trial time on the Minnesota Manual Dexterity Test.

A small utility room approximately 10' by 12' in the elementary school designated by the principal was used as the testing location. The four motor performance tests were

located on tables which were arranged in a way that the subject could rotate from one test to another easily. A test administrator was located at each test to give directions and record the test results. The testing stations were left intact between testing sessions.

Procedures

The data for this study was collected in two consecutive school days. Subjects were brought from their classroom to the testing room so that as subject one finished the first test and moved on to the second test, subject two started on the first test, and so on. The subjects stayed in the testing room until all four tests were finished, which took approximately fifteen minutes per subject. Having had written consent from their parents, the subjects knew they were taking part in a study that involved motor tests. The subjects appeared neither apprehensive nor apathetic toward the testing, but rather seemed quite fascinated by what they perceived to be "fun games." Previously selected subjects who were absent from school on the testing days were eliminated from the study.

Results

Design and Analysis

The data in this study was analyzed using a $2 \times 2 \times 3$ Repeated Measure ANCOVA, with age being used as a covariate. The layout of the design can be depicted by Table 1.

Table 1

Layout for 2 x 2 x 3 Repeated Measures ANCOVA

Layout

	HIGH						LOW					
	Male			Female			Male			Female		
	4	5	6	4	5	6	4	5	6	4	5	6
	1	2	3	4	5	6	7	8	9	10	11	12
1												
2												
3												
4												
5												
6												
7												
8												

There were three grouping factors in the study: sex of two levels, grade at three levels, and social status at two levels. There was one trial factor: the eight levels (trials) for the Tapping Test, Purdue Hand Precision Test, and the Pursuit Rotor Task in addition to the two levels (trials) for the Minnesota Manual Dexterity Test. Where significance was found, the Newman-Keuls Sequential Range Test was used to analyze mean scores. Descriptive statistics on the dependent variables are given in Table 2.

Table 2

Mean Scores On Dependent Variables

∞	Social	Grade	Sex	N	Tapping	PHPT	PHPT	PHPT	Pursuit	Minn. Man.
	Status	Level			Test	On Count	Stylus Count	On Time	Rotor	Dexterity
	High	4	M	5	<u>44.1</u>	20.4	22.5	3.6	3.6	63.5
	High	4	F	3	<u>47.2</u>	18.2	20.0	2.3	2.4	61.1
	High	5	M	7	<u>49.1</u>	20.5	22.1	3.0	6.1	55.5
	High	5	F	5	<u>44.1</u>	20.6	22.2	3.5	3.5	61.5
	High	6	M	4	<u>52.4</u>	20.1	22.7	4.3	5.8	54.7
	High	6	F	5	<u>50.8</u>	21.1	22.3	5.7	5.6	58.4
	Low	4	M	7	<u>43.5</u>	19.3	21.1	3.3	2.7	70.8
	Low	4	F	5	<u>40.9</u>	17.3	21.4	3.1	3.6	70.5
	Low	5	M	5	<u>50.5</u>	19.6	21.1	3.9	6.9	57.7
	Low	5	F	5	<u>44.8</u>	20.9	22.6	2.6	1.9	63.9
	Low	6	M	3	<u>56.0</u>	20.3	22.4	5.7	4.0	55.1
	Low	6	F	6	<u>48.2</u>	20.8	22.4	4.2	2.7	61.0

An example of the results of the repeated measures analysis of covariance are presented in Table 3. Two of the fine motor performance tasks, the Tapping Test and the Pursuit Rotor Task, showed significant differences between high and low social status groups in favor of the high social status group in each case. The Tapping Test produced means of 47.93 and 46.54 for the high and low social status groups, with the Pursuit Rotor Task producing means of 4.71 and 3.52 for high and low groups. Both of these mean differences were significant at the 5 percent level.

There was a significant difference noted among the three grade levels for the Purdue Hand Precision Test--On Time. Time on target increased as grade level increased, as noted by fourth, fifth and sixth grade means of 3.17, 3.23, and 4.89. This difference was significant at the 5 percent level.

There were no sex group differences noted for any of the fine motor performance tests. However, there were interaction effects involving three of the independent variables as noted in Table 3. Social status and grade level showed significant interaction effects on performance on the Purdue Hand Precision Test - On Count, and on the Pursuit Rotor Task. Social Status and sex showed significant interaction effects on performance on the Purdue Hand Precision Test - Stylus Count. The covariate, age, was not significant in any of the analysis.

Table 3

ANCOVA results for the Arm Tapping Speed Test.

Source	Sum of Squares	Degrees Of Freedom	Mean Square	F
S - Sex	30.97	1	30.97	.20
G - Grade Level	248.13	2	124.07	.81
I - Social Status	1173.08	1	1173.08	*7.70
S x G	386.81	2	193.40	1.27
S x I	511.25	1	511.25	3.36
G x I	645.71	2	322.86	2.12
S x G x I	195.09	2	97.55	.64
Covariate - Age	188.01	1	188.01	1.23
Error	7159.81	47	152.34	
R - Trials	156.35	7	22.34	1.83
R x S	89.35	7	12.76	1.05
R x G	141.03	14	10.07	.83
R x I	64.68	7	9.24	.76
R x S x G	131.41	14	9.39	.77
R x S x I	21.72	7	3.10	.25
R x G x I	129.33	14	9.24	.76
R x S x G x I	91.09	14	6.51	.53
Error	4099.04	336	12.20	
Total	15837.88	479		

*Significant at the .01 level.

Discussion

Since gross motor abilities in children have already been shown to differ significantly between high and low social status groups (Edwards, 1976), it was the purpose of this study to determine if fine motor performance differences existed between high and low social status groups; fourth, fifth and sixth graders, and males and females. The 2 x 2 x 3 repeated measures ANCOVA showed significance between high and low social status groups on two motor performance variables, and between grade levels on one motor performance variable. Interaction effects were noted for sex, grade level, and social status. The covariate, age, was not significant in any of the analysis.

The difference found for two of the four fine motor tasks used -- the Arm Tapping Speed Test and the Pursuit Rotor Task, but not for the Purdue Hand Precision Test and the Minnesota Manual Dexterity Text were rather interesting. When one considers the developmental direction principle of proximo-distal (midline to extremity) development one might ascribe some causality for only two of the four tests being significant to this principle. The Arm Tapping Speed Test and the Pursuit Rotor Task both take larger muscle movements to perform the task than do the Purdue Hand Precision Test and the Minnesota Manual Dexterity Test, which require fine motor control of fingers and wrist. Perhaps the non-significant tests were too difficult for all subjects to show any difference. The fact that the fine motor performance differences were shown between high and low social status

groups helps confirm conclusions of previous studies where gross motor coordination differences were found between those groups.

The significant difference among the three grade levels can also be partially explained by the developmental direction principle of proximo-distal development. One would expect children to improve in this fine finger control task as they increase in age, just as they improve in writing skills with age. Why the other three tests didn't show significance between grades cannot be explained. Perhaps the age range is not great enough to show enough variance on these tasks. Using the Pursuit Rotor Task, both Ammons (1955) using grades one, three, six, and nine, and Anshel (1979), using fifth and eighth grades, found significant differences in grade levels. It is noted, however, that in both of these studies, the range between ages were greater than in this study.

The non significant effect of sex was very interesting. In each of three previous studies involving gross motor performance (Keogh, 1965; Milne, 1976; and Phillips, 1955) there were significant differences found between males and females. However, Ammons (1955) found no significant sex differences on pursuit rotor performance for first, third, sixth, or ninth grade students. Anshel (1979) in a similar study, using the pursuit rotor test, also found no significant sex differences for grades five and eight. It appears that the finding of this study concerning sex differences is very consistent with previous findings. The advantage males seem

to have in gross motor performance testing seems to disappear in fine motor tests, indicating that the fine motor tests are probably free of a cultural or physical sex bias.

Conclusion

Within the limits of this study the following conclusions were made:

1. Differences in fine motor performance exist between high and low social status groups in favor of the high group.
2. Differences in fine motor performance may exist between fourth, fifth and sixth grader regardless of age.

Since gross motor performance differences have been reported between high and low social status groups in favor of the high groups in another similar study (Edwards, 1976), it was concluded that these fine motor performance differences help support the contention that high social status groups may be superior to low social groups on selected motor performance tasks.

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